

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
 US Department of Commerce  
 United States Patent and Trademark  
 Office, PCT  
 2011 South Clark Place Room  
 CP2/5C24  
 Arlington, VA 22202  
 ETATS-UNIS D'AMERIQUE  
 in its capacity as elected Office

Date of mailing (day/month/year) 15 February 2001 (15.02.01)	
International application No. PCT/GB00/02348	Applicant's or agent's file reference P100845PCT
International filing date (day/month/year) 15 June 2000 (15.06.00)	Priority date (day/month/year) 15 June 1999 (15.06.99)
Applicant KING, Walter, John	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

10 January 2001 (10.01.01)

☐ in a notice effecting later election filed with the International Bureau on:2. The election ☒ was☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Olivia TEFY Telephone No.: (41-22) 338.83.38
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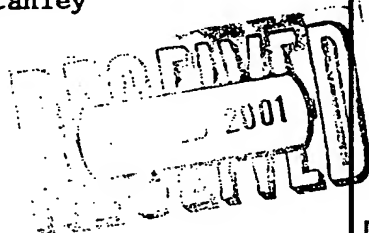
# INTERNATIONAL COOPERATION TREATY

## PCT

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

HARRISON, Ivor Stanley  
WITHERS & ROGERS  
Goldings House  
2 Hays Lane  
London SE1 2HW  
GRANDE BRETAGNE



### NOTIFICATION OF RECEIPT OF DEMAND BY COMPETENT INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

(PCT Rules 59.3(e) and 61.1(b), first sentence  
and Administrative Instructions, Section 601(a))

Date of mailing  
(day/month/year)

01.02.01

Applicant's or agent's file reference  
P100845PCT/ISH

#### IMPORTANT NOTIFICATION

International application No.

PCT/GB 00/ 02348

International filing date (day/month/year)

15/06/2000

Priority date (day/month/year)

15/06/1999

Applicant

DART SENSORS LIMITED et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority considers the following date as the date of receipt of the demand for international preliminary examination of the international application:

10/01/2001

2. This date of receipt is:

- ☒ the actual date of receipt of the demand by this Authority (Rule 61.1(b)).
- ☐ the actual date of receipt of the demand on behalf of this Authority (Rule 59.3(e)).
- ☐ the date on which this Authority has, in response to the invitation to correct defects in the demand (Form PCT/IPEA/404), received the required corrections.

3. ☐ **ATTENTION:** That date of receipt is **AFTER** the expiration of 19 months from the priority date. Consequently, the election(s) made in the demand does (do) not have the effect of postponing the entry into the national phase until 30 months from the priority date (or later in some Offices) (Article 39(1)). Therefore, the acts for entry into the national phase must be performed within 20 months from the priority date (or later in some Offices) (Article 22). For details, see the *PCT Applicant's Guide*, Volume II.

- ☐ (If applicable) This notification confirms the information given by telephone, facsimile transmission or in person on:

4. Only where paragraph 3 applies, a copy of this notification has been sent to the International Bureau.

Name and mailing address of the IPEA/



European Patent Office  
D-80298 Munich  
Tel. (+49-89) 2399-0, Tx: 523656 epmu d  
Fax: (+49-89) 2399-4465

Authorized officer

KENNEDY M B

Tel. (+49-89) 2399-2976



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## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P100845PCT/ISH	<b>FOR FURTHER ACTION</b>	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/GB00/02348	International filing date (day/month/year) 15/06/2000	Priority date (day/month/year) 15/06/1999
International Patent Classification (IPC) or national classification and IPC G01N27/413		
Applicant DART SENSORS LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 6 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand  10/01/2001	Date of completion of this report  10.09.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Komenda, P  Telephone No. +49 89 2399 2777 

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB00/02348

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):  
**Description, pages:**

1-4 as originally filed

**Claims, No.:**

1-12 with telefax of 13/07/2001

**Drawings, sheets:**

1/1 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:
- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.
4. The amendments have resulted in the cancellation of:
- ☐ the description, pages:
- ☐ the claims, Nos.:

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/02348

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

Novelty (N)	Yes:	Claims	1-11
	No:	Claims	12
Inventive step (IS)	Yes:	Claims	1-11
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-12
	No:	Claims	

2. Citations and explanations  
**see separate sheet**

## VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:  
**see separate sheet**

## VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:  
**see separate sheet**

**Section V:**

Reference is made to the following documents:

D1 = RUSSIAN PATENTS ABSTRACTS Section Ch, Week 199329 Derwent Publications Ltd., London, GB; Class E36, AN 1993-234148 & SU 1 749 815 A (ELECTROCHEM INST), 23 July 1992 (1992-07-23)  
D2 = Database WPI, abstract of JP 52 088282  
D3 = WO 96/37771

**N:** Document D1 represents the nearest available prior art with respect to new independent claim 1 and reveals a carbon monoxide sensor apparatus comprising pretreatment means and sensor means. The pretreatment means comprises an aqueous medium (25-60% sulphuric acid) to adsorb contaminating substances from a gaseous test sample. The measurement appears to be performed at ambient temperatures also. The subject-matter of claim 1 differs from that of D1 in that it additionally comprises catalytic means to convert contaminating substances to non-contaminating substances, the said catalytic means operating at ambient temperatures (Article 33(2) PCT).

New independent method claim 12 does not specify that conversion of said contaminating substances into non-contaminating substances occurs by means of a catalyst operating at ambient temperatures. Thus the method for sensing CO as known from D1 falls under the scope of claim 12 which is thus not novel (Article 33(2) PCT).

**IS:** The technical problem to be solved is to remove the absorbed contaminating substances which would otherwise accumulate in and eventually saturate the pretreatment means.

This problem is solved by the use of the aforementioned catalytic means.

Document D2 describes chemical trapping of interfering gases in CO measurement using an absorbent which comprises a chromium (VI) compound and sulphuric acid. Since no removal of the absorbed gases is envisaged, no

solution therefore is provided i.e. no catalyst is disclosed.

Document D3 describes the use of a catalyst in CO determination for removing (either reducing or oxidising) interfering components from the gas sample. For operational purposes it is necessary to heat the catalyst. There is no indication that said catalyst could be used in conjunction with absorbing means, let alone an indication to operate the catalyst at ambient temperature. The combination of the disclosures of D1 and D3 would thus not lead to the subject-matter of claim 1 (Article 33(3) PCT).

Claims 2-11 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

**IA:** Industrial applicability is also acknowledged (Article 33(4) PCT).

**Section VII:**

1. The description is not in conformity with the new claims (page 1, 4th paragraph).
2. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed the document D1-D3 is not mentioned in the description, nor are these documents identified therein.
3. The independent claims are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (document D1) being placed in a preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in a characterising part (Rule 6.3(b)(ii) PCT).
4. The features of the device claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB00/02348

**Section VIII:**

1. In order to render claim 12 consistent with amended claim 1 the essential feature of using a catalyst which operates at ambient temperatures must be introduced into claim 12.



# PCT

## REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference  
(if desired) (12 characters maximum) P100845PCT

**Box No. I TITLE OF INVENTION**

CARBON MONOXIDE SENSOR

**Box No. II APPLICANT**

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

DART SENSORS LIMITED  
DART MARINE PARK  
TOTNES  
DEVON TQ9 5AL

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State (that is, country) of nationality:  
GB

State (that is, country) of residence:  
GB

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

**Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)**

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

KING, WALTER JOHN  
THE GARDENS  
PRIORY ORCHARD  
TOTNES  
DEVON TQ9 5HR

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:  
GB

State (that is, country) of residence:  
GB

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on a continuation sheet.

**Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

☒ agent ☐ common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)  
HARRISON, IVOR STANLEY

WITHERS & ROGERS  
GOLDINGS HOUSE  
2 HAYS LANE  
LONDON SE1 2HW

Telephone No.

+44 117 925 3030

Facsimile No.

+44 117 925 3530

Teleprinter No.

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

**Box No.V DESIGNATION OF STATES**

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

**Regional Patent**

- ☒ **AP ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ **EA Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP European Patent:** AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ **OA OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line) .....

**National Patent (if other kind of protection or treatment desired, specify on dotted line):**

- |                                                                                     |                                                                                         |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> <b>AE</b> United Arab Emirates                  | <input checked="" type="checkbox"/> <b>LR</b> Liberia                                   |
| <input checked="" type="checkbox"/> <b>AL</b> Albania                               | <input checked="" type="checkbox"/> <b>LS</b> Lesotho                                   |
| <input checked="" type="checkbox"/> <b>AM</b> Armenia                               | <input checked="" type="checkbox"/> <b>LT</b> Lithuania                                 |
| <input checked="" type="checkbox"/> <b>AT</b> Austria                               | <input checked="" type="checkbox"/> <b>LU</b> Luxembourg                                |
| <input checked="" type="checkbox"/> <b>AU</b> Australia                             | <input checked="" type="checkbox"/> <b>LV</b> Latvia                                    |
| <input checked="" type="checkbox"/> <b>AZ</b> Azerbaijan                            | <input checked="" type="checkbox"/> <b>MA</b> Morocco                                   |
| <input checked="" type="checkbox"/> <b>BA</b> Bosnia and Herzegovina                | <input checked="" type="checkbox"/> <b>MD</b> Republic of Moldova                       |
| <input checked="" type="checkbox"/> <b>BB</b> Barbados                              | <input checked="" type="checkbox"/> <b>MG</b> Madagascar                                |
| <input checked="" type="checkbox"/> <b>BG</b> Bulgaria                              | <input checked="" type="checkbox"/> <b>MK</b> The former Yugoslav Republic of Macedonia |
| <input checked="" type="checkbox"/> <b>BR</b> Brazil                                | <input checked="" type="checkbox"/> <b>MN</b> Mongolia                                  |
| <input checked="" type="checkbox"/> <b>BY</b> Belarus                               | <input checked="" type="checkbox"/> <b>MW</b> Malawi                                    |
| <input checked="" type="checkbox"/> <b>CA</b> Canada                                | <input checked="" type="checkbox"/> <b>MX</b> Mexico                                    |
| <input checked="" type="checkbox"/> <b>CH and LI</b> Switzerland and Liechtenstein  | <input checked="" type="checkbox"/> <b>NO</b> Norway                                    |
| <input checked="" type="checkbox"/> <b>CN</b> China                                 | <input checked="" type="checkbox"/> <b>NZ</b> New Zealand                               |
| <input checked="" type="checkbox"/> <b>CR</b> Costa Rica                            | <input checked="" type="checkbox"/> <b>PL</b> Poland                                    |
| <input checked="" type="checkbox"/> <b>CU</b> Cuba                                  | <input checked="" type="checkbox"/> <b>PT</b> Portugal                                  |
| <input checked="" type="checkbox"/> <b>CZ</b> Czech Republic                        | <input checked="" type="checkbox"/> <b>RO</b> Romania                                   |
| <input checked="" type="checkbox"/> <b>DE</b> Germany                               | <input checked="" type="checkbox"/> <b>RU</b> Russian Federation                        |
| <input checked="" type="checkbox"/> <b>DK</b> Denmark                               | <input checked="" type="checkbox"/> <b>SD</b> Sudan                                     |
| <input checked="" type="checkbox"/> <b>DM</b> Dominica                              | <input checked="" type="checkbox"/> <b>SE</b> Sweden                                    |
| <input checked="" type="checkbox"/> <b>EE</b> Estonia                               | <input checked="" type="checkbox"/> <b>SG</b> Singapore                                 |
| <input checked="" type="checkbox"/> <b>ES</b> Spain                                 | <input checked="" type="checkbox"/> <b>SI</b> Slovenia                                  |
| <input checked="" type="checkbox"/> <b>FI</b> Finland                               | <input checked="" type="checkbox"/> <b>SK</b> Slovakia                                  |
| <input checked="" type="checkbox"/> <b>GB</b> United Kingdom                        | <input checked="" type="checkbox"/> <b>SL</b> Sierra Leone                              |
| <input checked="" type="checkbox"/> <b>GD</b> Grenada                               | <input checked="" type="checkbox"/> <b>TJ</b> Tajikistan                                |
| <input checked="" type="checkbox"/> <b>GE</b> Georgia                               | <input checked="" type="checkbox"/> <b>TM</b> Turkmenistan                              |
| <input checked="" type="checkbox"/> <b>GH</b> Ghana                                 | <input checked="" type="checkbox"/> <b>TR</b> Turkey                                    |
| <input checked="" type="checkbox"/> <b>GM</b> Gambia                                | <input checked="" type="checkbox"/> <b>TT</b> Trinidad and Tobago                       |
| <input checked="" type="checkbox"/> <b>HR</b> Croatia                               | <input checked="" type="checkbox"/> <b>TZ</b> United Republic of Tanzania               |
| <input checked="" type="checkbox"/> <b>HU</b> Hungary                               | <input checked="" type="checkbox"/> <b>UA</b> Ukraine                                   |
| <input checked="" type="checkbox"/> <b>ID</b> Indonesia                             | <input checked="" type="checkbox"/> <b>UG</b> Uganda                                    |
| <input checked="" type="checkbox"/> <b>IL</b> Israel                                | <input checked="" type="checkbox"/> <b>US</b> United States of America                  |
| <input checked="" type="checkbox"/> <b>IN</b> India                                 | <input checked="" type="checkbox"/> <b>UZ</b> Uzbekistan                                |
| <input checked="" type="checkbox"/> <b>IS</b> Iceland                               | <input checked="" type="checkbox"/> <b>VN</b> Viet Nam                                  |
| <input checked="" type="checkbox"/> <b>JP</b> Japan                                 | <input checked="" type="checkbox"/> <b>YU</b> Yugoslavia                                |
| <input checked="" type="checkbox"/> <b>KE</b> Kenya                                 | <input checked="" type="checkbox"/> <b>ZA</b> South Africa                              |
| <input checked="" type="checkbox"/> <b>KG</b> Kyrgyzstan                            | <input checked="" type="checkbox"/> <b>ZW</b> Zimbabwe                                  |
| <input checked="" type="checkbox"/> <b>KP</b> Democratic People's Republic of Korea |                                                                                         |
| <input checked="" type="checkbox"/> <b>KR</b> Republic of Korea                     |                                                                                         |
| <input checked="" type="checkbox"/> <b>KZ</b> Kazakhstan                            |                                                                                         |
| <input checked="" type="checkbox"/> <b>LC</b> Saint Lucia                           |                                                                                         |
| <input checked="" type="checkbox"/> <b>LK</b> Sri Lanka                             |                                                                                         |

Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:

- ☐ .....
- ☐ .....

**Precautionary Designation Statement:** In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)

**Supplemental Box** *If the Supplemental Box is not used, this sheet should not be included in the request.*

1. *If, in any of the Boxes, the space is insufficient to furnish all the information: in such case, write "Continuation of Box No. ..." [indicate the number of the Box] and furnish the information in the same manner as required according to the captions of the Box in which the space was insufficient, in particular:*

- (i) *If more than two persons are involved as applicants and/or inventors and no "continuation sheet" is available, in such case, write "Continuation of Box No. III" and indicate for each additional person the same type of information as required in Box No. III. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below:*
  - (ii) *If, in Box No. II or in any of the sub-boxes of Box No. III, the indication "the States indicated in the Supplemental Box" is checked: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the applicant(s) involved and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is applicant:*
  - (iii) *If, in Box No. II or in any of the sub-boxes of Box III, the inventor or the inventor/applicant is not inventor for the purposes of all designates States or for the purposes of the United States of America: in such case, write "Continuation of Box No. II" or inventor(s) and next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is inventor:*
  - (iv) *If, in addition to the agent(s) indicated in Box No. IV, there are further agents: in such case, write "Continuation of Box No. IV" and indicate for each further agent the same type of information as required in Box No. IV:*
  - (v) *If, in Box No. V, the name of any State (or OAPI) is accompanied by an indication "continuation" or "continuation-in-part": in such case, write "Continuation of Box No. V" and the name of each State involved (or OAPI), and after the name of each such State (or OAPI), the number of the parent title or parent application and the date of grant of the parent title or filing of the parent application:*
  - (vi) *If, in Box No. VI, there are more than three earlier applications whose priority is claimed: in such case, write "Continuation of Box No. IV" and indicate for each additional earlier application the same type of information as required in Box No. VI:*
  - (vii) *If, in Box No. IV, the earlier application is an ARIPO application: in such case, write "Continuation of Box No. VI", specify the number of the item corresponding to that earlier application and indicate at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed.*
2. *If, with regard to the precautionary designation statement contained in Box No. V, the applicant wishes to exclude any State(s) from the scope of that statement: in such case, write "Designation(s) excluded from precautionary designation statement" and indicate the name or two-letter code of each State so excluded.*
3. *If the applicant claims, in respect of any designated Office, the benefits of provisions of the national law concerning non-prejudicial disclosures or exceptions to lack of novelty: in such case, write "Statement concerning non-prejudicial disclosures or exceptions to lack of novelty" and furnish that statement below.*

**Continuation of Box IV**

D. G. Bannerman  
N. M. Wilson  
W. M. Blatchford  
M. Adkins  
A. J. Chettle  
J. K. Hogg  
J. P. Dean

I. S. Harrison  
D. M. Pratt  
B. J. N. Dempster  
K. J. Barnfather  
S. A. Beck  
P. C. Turner  
H. H. B. Wright

D. Croston  
D. C. Jones  
J. B. Jones

of

**WITHERS & ROGERS  
GOLDINGS HOUSE  
2 HAYS LANE  
LONDON SE1 2HW  
GB**

Box No. VI PRIORITY CLAIM		<input type="checkbox"/> Further priority claims are indicated in the Supplemental Box.		
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application: regional Office	international application: receiving Office
item (1) 15 JUNE 1999	9913946.1	GB		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s): (1)

\* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

**Box No. VII INTERNATIONAL SEARCHING AUTHORITY**

**Choice of International Searching Authority (ISA)**  
(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):

**Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):**

Date (day/month/year) Number Country (or regional Office)

ISA /

**Box No. VIII CHECK LIST; LANGUAGE OF FILING**

This international application contains the following number of sheets:

request : 4  
description (excluding sequence listing part) : 4  
claims : 2  
abstract : 1  
drawings : 2  
sequence listing part of description :  
Total number of sheets : 13

This international application is accompanied by the item(s) marked below:

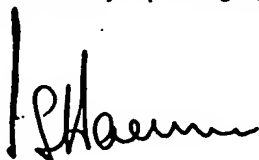
1. ☐ fee calculation sheet
2. ☒ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☒ other (specify): PATENTS FORM 23/77

Figure of the drawings which should accompany the abstract:

Language of filing of the international application:

**Box No. IX SIGNATURE OF APPLICANT OR AGENT**

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).



HARRISON, IVOR STANLEY

For receiving Office use only		2. Drawings:  <input type="checkbox"/> received:  <input type="checkbox"/> not received:
1. Date of actual receipt of the purported international application:		
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:		
4. Date of timely receipt of the required corrections under PCT Article 11(2):		
5. International Searching Authority (if two or more are competent): ISA /	6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.	

For International Bureau use only	
Date of receipt of the record copy by the International Bureau:	

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ \_\_\_\_\_

# PCT

## CHAPTER II

### DEMAND

under Article 31 of the Patent Cooperation Treaty:  
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only	
Identification of IPEA	Date of receipt of DEMAND
<b>Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION</b>	
Applicant's or agent's file reference P100845PCT/ISH	
International application No. PCT/GB00/02348	International filing date (day/month/year) 15/06/00
(Earliest) Priority date (day/month/year) 15/06/99	
Title of invention CARBON MONOXIDE SENSOR	
<b>Box No. II APPLICANT(S)</b>	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)	
DART SENSORS LIMITED DART MARINE PARK TOTNES DEVON TQ9 5AL UNITED KINGDOM	
Telephone No.:	
Facsimile No.:	
Teleprinter No.:	
State (that is, country) of nationality: GB	State (that is, country) of residence: GB
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)	
State (that is, country) of nationality:	State (that is, country) of residence:
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)	
KING, WALTER JOHN THE GARDENS PRIORY ORCHARD TOTNES DEVON TQ9 5HR UNITED KINGDOM	
State (that is, country) of nationality: GB	State (that is, country) of residence: GB
<input type="checkbox"/> Further applicants are indicated on a continuation sheet	

**Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**The following person is ☒ agent ☐ common representativeand ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*HARRISON, IVOR STANLEY  
WITHERS & ROGERS  
GOLDINGS HOUSE  
2 HAYS LANE  
LONDON  
SE1 2HW  
UNITED KINGDOM

Telephone No.:

+44 117 925 3030

Facsimile No.:

+44 117 925 3530

Teleprinter No.:

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:\***

1. The applicant wishes the international preliminary examination to start on the basis of:

☒ the international application as originally filedthe description ☐ as originally filed☐ as amended under Article 34the claims ☐ as originally filed☐ as amended under Article 19 (together with any accompanying statement)☐ as amended under Article 34the drawings ☐ as originally filed☐ as amended under Article 342. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

\* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: ENGLISH☒ which is the language in which the international application was filed.☐ which is the language of a translation furnished for the purposes of international search.☐ which is the language of publication of the international application.☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.**Box No. V ELECTION OF STATES**The applicant hereby elects all eligible States *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes not to elect:

## Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- |                                                                          |   |        |
|--------------------------------------------------------------------------|---|--------|
| 1. translation of international application                              | : | sheets |
| 2. amendments under Article 34                                           | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19  | : | sheets |
| 5. letter                                                                | : | sheets |
| 6. other (specify)                                                       | : | sheets |

For International Preliminary  
Examining Authority use only

received not received


<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

- |                                                                                          |                                                                                                     |
|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| 1. <input checked="" type="checkbox"/> fee calculation sheet                             | 4. <input type="checkbox"/> statement explaining lack of signature                                  |
| 2. <input type="checkbox"/> separate signed power of attorney                            | 5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form |
| 3. <input type="checkbox"/> copy of general power of attorney, reference number, if any: | 6. <input type="checkbox"/> other (specify):                                                        |

## Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

  
.....  
HARRISON, IVOR STANLEY

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

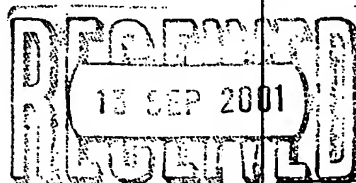
# PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

# PCT

To:

HARRISON, Ivor Stanley  
WITHERS & ROGERS  
Goldings House  
2 Hays Lane  
London SE1 2HW  
GRANDE BRETAGNE



NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT  
(PCT Rule 71.1)

Date of mailing  
(day/month/year) 10.09.2001

Applicant's or agent's file reference  
P100845PCT/ISH

## IMPORTANT NOTIFICATION

International application No.  
PCT/GB00/02348

International filing date (day/month/year)  
15/06/2000

Priority date (day/month/year)  
15/06/1999

Applicant  
DART SENSORS LIMITED et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.


### 4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/

 European Patent Office  
D-80298 Munich  
Tel. +49 89 2399 - 0 Tx: 523656 epmu d  
Fax: +49 89 2399 - 4465

Authorized officer

Conner, M

Tel. +49 89 2399-2241





# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>P100845PCT/ISH</b>	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. <b>PCT/GB00/02348</b>	International filing date (day/month/year) <b>15/06/2000</b>	Priority date (day/month/year) <b>15/06/1999</b>
International Patent Classification (IPC) or national classification and IPC <b>G01N27/413</b>		
Applicant <b>DART SENSORS LIMITED et al.</b>		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.


2. This REPORT consists of a total of 6 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand  <b>10/01/2001</b>	Date of completion of this report  <b>10.09.2001</b>
Name and mailing address of the international preliminary examining authority:   <b>European Patent Office</b> <b>D-80298 Munich</b> <b>Tel. +49 89 2399 - 0 Tx: 523656 epmu d</b> <b>Fax: +49 89 2399 - 4465</b>	Authorized officer  <b>Komenda, P</b>  Telephone No. <b>+49 89 2399 2777</b>



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB00/02348

**I. Basis of the report**

1. With regard to the elements of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, pages:**

1-4 as originally filed

**Claims, No.:**

1-12 with telefax of 13/07/2001

**Drawings, sheets:**

1/1 as originally filed

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/02348

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

Novelty (N)	Yes:	Claims	1-11
	No:	Claims	12
Inventive step (IS)	Yes:	Claims	1-11
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-12
	No:	Claims	

2. Citations and explanations  
see separate sheet

## VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:  
see separate sheet

## VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:  
see separate sheet

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

---

International application No. PCT/GB00/02348

**Section V:**

Reference is made to the following documents:

- D1 = RUSSIAN PATENTS ABSTRACTS Section Ch, Week 199329 Derwent Publications Ltd., London, GB; Class E36, AN 1993-234148 & SU 1 749 815 A (ELECTROCHEM INST), 23 July 1992 (1992-07-23)  
D2 = Database WPI, abstract of JP 52 088282  
D3 = WO 96/37771

**N:** Document D1 represents the nearest available prior art with respect to new independent claim 1 and reveals a carbon monoxide sensor apparatus comprising pretreatment means and sensor means. The pretreatment means comprises an aqueous medium (25-60% sulphuric acid) to adsorb contaminating substances from a gaseous test sample. The measurement appears to be performed at ambient temperatures also. The subject-matter of claim 1 differs from that of D1 in that it additionally comprises catalytic means to convert contaminating substances to non-contaminating substances, the said catalytic means operating at ambient temperatures (Article 33(2) PCT).

New independent method claim 12 does not specify that conversion of said contaminating substances into non-contaminating substances occurs by means of a catalyst operating at ambient temperatures. Thus the method for sensing CO as known from D1 falls under the scope of claim 12 which is thus not novel (Article 33(2) PCT).

**IS:** The technical problem to be solved is to remove the absorbed contaminating substances which would otherwise accumulate in and eventually saturate the pretreatment means.

This problem is solved by the use of the aforementioned catalytic means.

Document D2 describes chemical trapping of interfering gases in CO measurement using an absorbent which comprises a chromium (VI) compound and sulphuric acid. Since no removal of the absorbed gases is envisaged, no

solution therefore is provided i.e. no catalyst is disclosed.

Document D3 describes the use of a catalyst in CO determination for removing (either reducing or oxidising) interfering components from the gas sample. For operational purposes it is necessary to heat the catalyst. There is no indication that said catalyst could be used in conjunction with absorbing means, let alone an indication to operate the catalyst at ambient temperature. The combination of the disclosures of D1 and D3 would thus not lead to the subject-matter of claim 1 (Article 33(3) PCT).

Claims 2-11 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

**IA:** Industrial applicability is also acknowledged (Article 33(4) PCT).

#### **Section VII:**

1. The description is not in conformity with the new claims (page 1, 4th paragraph).
2. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed the document D1-D3 is not mentioned in the description, nor are these documents identified therein.
3. The independent claims are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (document D1) being placed in a preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in a characterising part (Rule 6.3(b)(ii) PCT).
4. The features of the device claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

---

International application No. PCT/GB00/02348

**Section VIII:**

1. In order to render claim 12 consistent with amended claim 1 the essential feature of using a catalyst which operates at ambient temperatures must be introduced into claim 12.

## Claims

1. Carbon monoxide sensor apparatus comprising pre-treatment means and sensor means, in which the pre-treatment means comprises an aqueous medium to absorb contaminating substances from a gaseous test substrate and catalytic means to convert contaminating substances to non-contaminating substances at ambient temperatures.
2. Apparatus according to claim 1, in which the pre-treatment and sensor means are contained in separate chambers in mutual communication, the pretreatment chamber including access means for the gaseous test substrate.
3. Apparatus according to claim 1 or claim 2, in which the sensor means comprise an electrochemical sensor comprising two electrochemically-active electrodes separated by an electrolyte absorbed on a porous substrate.
4. Apparatus according to claim 3, in which the sensor electrodes comprise a precious metal as catalyst.
5. Apparatus according to claim 4, in which the catalyst is disposed on a porous support.
6. Apparatus according to claim 4, in which the catalyst is applied direct to the electrode surface in finely-divided form.
7. Apparatus according to any of claims 3 to 6, in which the porous substrate comprises a plastics polymeric material.
8. Apparatus according to any of claims 3 to 7, in which the electrolyte is acidic.
9. Apparatus according to any preceding claim, in which the aqueous medium contains sulphuric acid or other water-retention substance.
10. Apparatus according to any preceding claim, in which the aqueous medium is absorbed on a solid absorbent matrix.
11. Apparatus according to any preceding claim and including a porous barrier to exclude airborne particulates from the pre-treatment means.

12. A method for sensing the presence of carbon monoxide in a gaseous test substrate which may also contain contaminating substances, the method comprising pre-treating the substrate by passage thereof through an aqueous medium to absorb any contaminating substances at ambient temperatures and to convert said contaminating substances to non-contaminating substances and testing the residue of the test substrate for the presence of carbon monoxide.



**Claims**

1. Carbon monoxide sensor apparatus comprising pre-treatment means and sensor means, the pre-treatment means comprising means to absorb contaminating substances from a gaseous test substrate and means to convert contaminating substances to non-contaminating substances.
2. Apparatus according to claim 1, in which the pre-treatment and sensor means are contained in separate chambers in mutual communication, the pretreatment chamber including access means for the gaseous test substrate.
3. Apparatus according to claim 1 or claim 2, in which the sensor means comprise an electrochemical sensor comprising two electrochemically-active electrodes separated by an electrolyte absorbed on a porous substrate.
4. Apparatus according to claim 3, in which the sensor electrodes comprise a precious metal as catalyst.
5. Apparatus according to claim 4, in which the catalyst is disposed on a porous support.
6. Apparatus according to claim 4, in which the catalyst is applied direct to the electrode surface in finely-divided form.
7. Apparatus according to any of claims 3 to 6, in which the porous substrate comprises a plastics polymeric material.
8. Apparatus according to any of claims 3 to 7, in which the electrolyte is acidic.
9. Apparatus according to any preceding claim, in which the absorption pre-treatment means comprises an aqueous medium.
10. Apparatus according to claim 9, in which the aqueous medium contains sulphuric acid or other water-retention substance.
11. Apparatus according to claim 9 or claim 10, in which the aqueous medium is absorbed on a solid absorbent matrix.
12. Apparatus according to any preceding claim and including a porous barrier to exclude airborne particulates from the pre-treatment means.

13. A method for sensing the presence of carbon monoxide in a gaseous test substrate which may also contain contaminating substances, the method comprising pre-treating the substrate to absorb any contaminating substances and to convert said contaminating substances to non-contaminating substances and testing the residue of the test substrate for the presence of carbon monoxide.

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>P100845PCT</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/GB 00/ 02348</b>	International filing date (day/month/year) <b>15/06/2000</b>	(Earliest) Priority Date (day/month/year) <b>15/06/1999</b>
Applicant <b>DART SENSORS LIMITED</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

### 1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1  
☐ None of the figures.

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/02348

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G01N27/413

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 710 835 A (TOYOTA JIDOSHA K K) 8 May 1996 (1996-05-08) abstract; figure 1 ---	1-13
Y	RUSSIAN PATENTS ABSTRACTS Section Ch, Week 199329 Derwent Publications Ltd., London, GB; Class E36, AN 1993-234148 XP002901271 & SU 1 749 815 A (ELECTROCHEM INST), 23 July 1992 (1992-07-23) abstract --- -/--	1-13



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

## \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\* & \* document member of the same patent family

Date of the actual completion of the international search

20 September 2000

Date of mailing of the international search report

13. 11. 00

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Nardai

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/02348

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DATABASE WPI Section Ch, Week 197736 Derwent Publications Ltd., London, GB; Class J01, AN 1977-636741Y XP002901272 & JP 52 088282 A (RIKEN KEIKI KK), 23 July 1977 (1977-07-23) abstract ---	1-13
Y	WO 96 37771 A (SIEMENS AG ) 28 November 1996 (1996-11-28) claims; figures -----	1-13

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/02348

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0710835 A	08-05-1996	JP 8327590 A	13-12-1996
		EP 0710996 A	08-05-1996
		JP 8329969 A	13-12-1996
		KR 170035 B	30-03-1999
		KR 171206 B	30-03-1999
		US 5712052 A	27-01-1998
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(71) Applicant (*for all designated States except US*): DART  
SENSORS LIMITED [GB/GB]; Dart Marine Park,  
Totnes, Devon TQ9 5AL (GB).

(72) Inventor; and

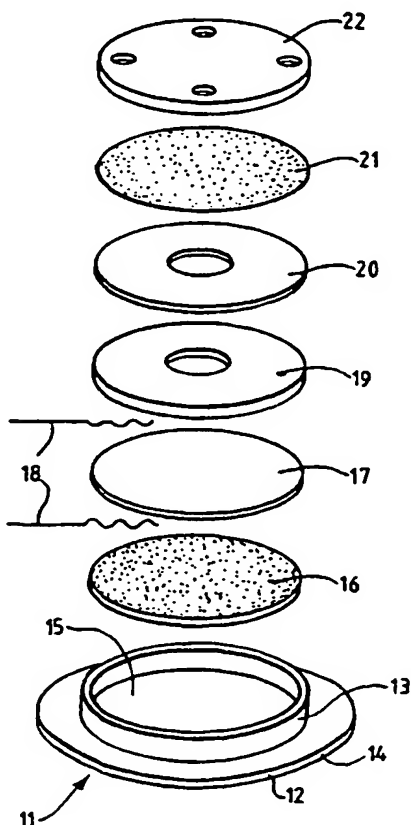
(75) Inventor/Applicant (*for US only*): KING, Walter, John

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(54) Title: CARBON MONOXIDE SENSOR

(57) Abstract: A method and apparatus for detecting the presence of carbon  
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Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Nardai

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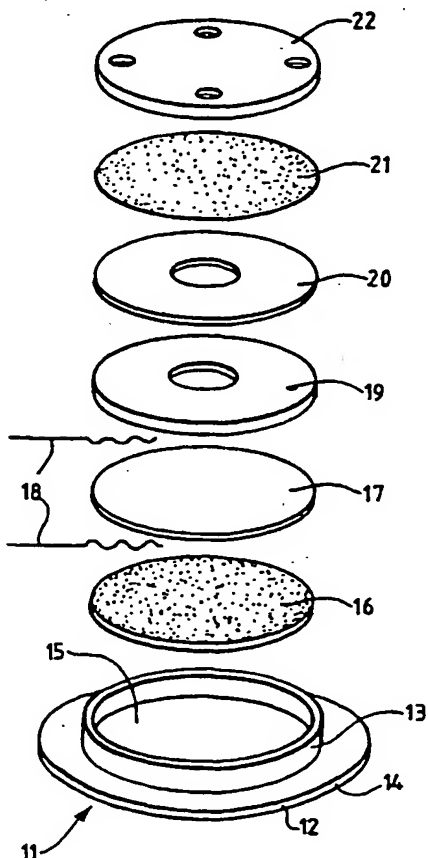
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## **Carbon Monoxide Sensor**

This invention relates to apparatus for detection of carbon monoxide.

Among the available methods of detecting carbon monoxide, electrochemical sensors have shown great promise as they are relatively cheap, sensitive and reliable. However, they suffer the disadvantage that they are inherently sensitive to a wide range of substances and as a result are liable to give erroneous responses in service.

It is an object of the present invention to provide a carbon monoxide sensor which is of enhanced specificity compared with electrochemical sensors and which preferably does not require a source of power.

According to one aspect of the present invention, a carbon monoxide sensor comprises pre-treatment means and sensor means, the pre-treatment means comprising means to absorb contaminating substances and means to convert contaminating substances to non-contaminating substances.

By "contaminating substances" is meant elements or compounds in gaseous or vapour form which if incident on the sensor means would themselves be detected and which could thus give rise to an erroneous or misleading result of carbon monoxide presence or concentration.

Preferably, the pre-treatment and sensor means are contained in separate chambers which are in mutual communication, the pretreatment chamber including access means for the gaseous test substrate.

The sensor means may comprise an electrochemical sensor preferably of the fuel cell type and comprising two electrochemically-active electrodes separated by an electrolyte absorbed on a porous substrate. The electrodes are electrically connected to a display device by current-carrying leads which preferably comprise platinum wire. The sensor electrodes may comprise a precious metal as catalyst, optionally disposed on a suitable

support or, alternatively, applied direct to the electrode surface in finely-divided form such as platinum black. The porous substrate may comprise a plastics polymeric material such as polyvinyl chloride or polyethylene and the electrolyte is preferably acidic, such as sulphuric acid at a concentration between 0.1 and 10M.

The absorption pre-treatment means is preferably an aqueous medium, since most of the common contaminating substances including ammonia, sulphur dioxide, hydrogen sulphide, ethanol and other organic contaminants such as other alcohols and aldehydes, as well as acidic and alkaline gaseous substances, are soluble or highly soluble in water.

The partition coefficients between air and water for the above compounds are as follows: ammonia 0.0014 (20°C); sulphur dioxide 0.0125 (20°C); hydrogen sulphide 0.37 (20°) and ethanol 0.0004 (34°C). By contrast, carbon monoxide has a partition coefficient of 45 (20°C) and thus is predominantly non-absorbed by an aqueous pre-treatment means.

To inhibit evaporation and to prevent eventual drying, the aqueous medium preferably contains sulphuric acid or other water-retention substance.

The aqueous medium is preferably itself absorbed on a solid absorbent matrix such as porous polyethylene, polyvinyl chloride or other inert plastics material.

The function of the conversion pre-treatment means is to oxidise the absorbed contaminating substances which would otherwise accumulate in and eventually saturate the absorption medium. The conversion means is preferably chemically catalytically active to avoid the need for a source of power; the catalyst is preferably a heterogeneous catalyst comprising platinum or other precious metal which may be dispersed on a support material such as activated carbon or a zeolite provided that the catalyst is not thereby made active for carbon monoxide oxidation. However, the preferred catalyst is finely divided platinum metal such as platinum black.

Preferably, the sensor includes a porous barrier to exclude airborne particulates from the pre-treatment means.

In another embodiment, the invention provides a method for sensing the presence of carbon monoxide in a gaseous test substrate which may also contain contaminating substances, the method comprising pre-treating the substrate to absorb any contaminating substances and to convert said contaminating substances to non-contaminating substances and testing the residue of the test substrate for the presence of carbon monoxide.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings, of which

Figure 1 is an exploded view of the component parts of a carbon monoxide sensor and

Figure 2 is a cross sectional view of the sensor made from the parts shown in Figure 1.

Referring firstly to Figure 1, the sensor device has a base housing 11 in the form of a circular plate 12 having an upstanding annular wall 13 defining an outer annular flange 14 and a central circular cavity 15. At the bottom of the cavity is placed a circular disc 16 of porous polyvinyl chloride containing 5M sulphuric acid solution absorbed therein and the electrodes are placed thereon. The electrodes are constituted by a porous polyvinyl chloride disc 17 with 5M sulphuric acid absorbed therein and coated on its surfaces with respective catalytic layers of platinum black, the upper surface being the working electrode for electrochemical oxidation of carbon monoxide and the lower surface being the counter-electrode to complete the electrochemical circuit by reduction of oxygen. Connecting wires 18 pass the electricity generated to a warning or display device (not shown).

Over the working electrode is placed an impervious annular disc 19 having a depending outer flange 19A which spaces the disc 19 from the working electrode to form a sensor chamber B (Figure 2). The disc carries an annular sheet of porous polyvinyl chloride 20 having dilute sulphuric acid absorbed therein and carrying a catalytic surface coating of platinum black. A circular disc or membrane 21 of porous PTFE overlies the sheet 20 and acts as a barrier layer to exclude particulates, and a top plate 22 having holes formed therein is inserted at the top of the cavity 15. The plate 22 has a depending outer flange



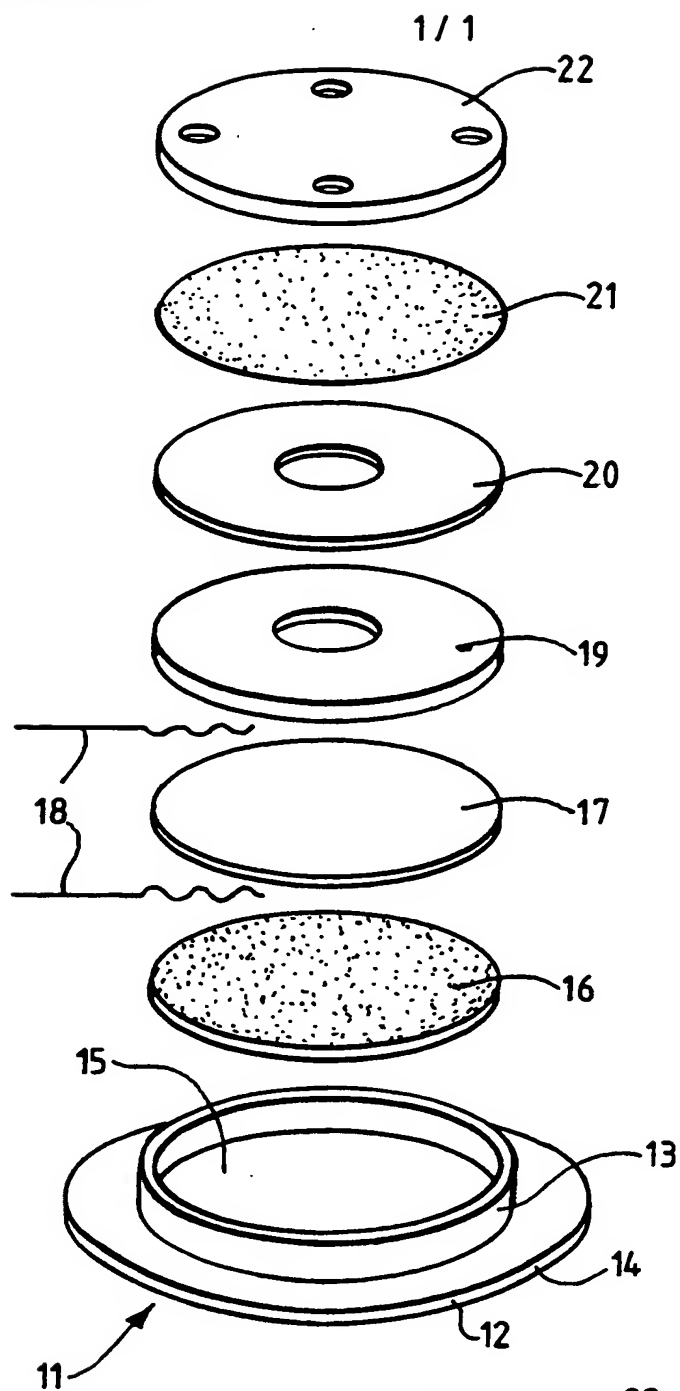
22A which spaces the plate from the barrier layer to form in conjunction with the barrier layer and annular sheet 20 a pretreatment chamber A .

In use, ambient air passes by diffusion through the holes in plate 22 into pretreatment chamber A where it initially passes through the interstices of disc 21 to reach the pretreatment element 20. Most contaminating substances are trapped in element 20 by absorption and catalytic oxidation and carbon monoxide molecules pass through the central hole in the pretreatment element 20, in registration with the central hole in disc 19, into the sensor chamber B. The carbon monoxide is oxidised to carbon dioxide on the upper catalytic surface, the resulting electrical output being proportional to the carbon monoxide concentration. The circular disc 16 containing absorbed sulphuric acid acts as a reservoir which feeds or drains the sensor electrode as the volume of electrolyte expands and contracts with temperature and humidity changes.

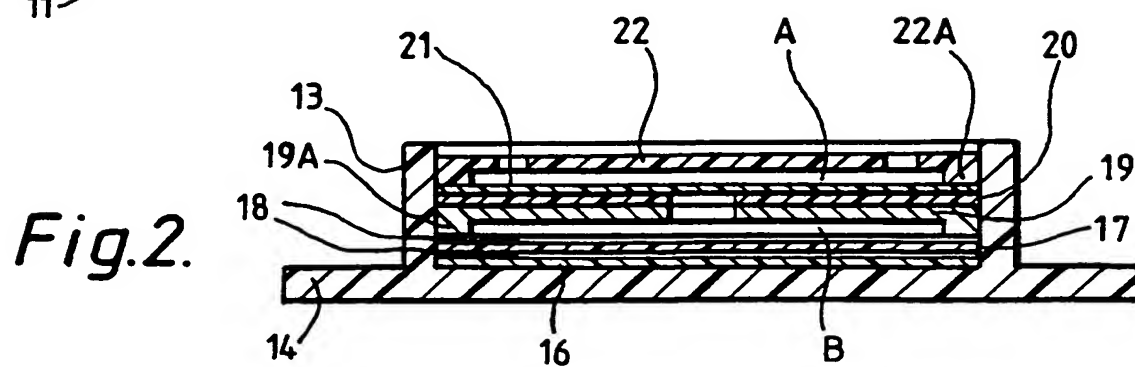
**Claims**

1. Carbon monoxide sensor apparatus comprising pre-treatment means and sensor means, the pre-treatment means comprising means to absorb contaminating substances from a gaseous test substrate and means to convert contaminating substances to non-contaminating substances.
2. Apparatus according to claim 1, in which the pre-treatment and sensor means are contained in separate chambers in mutual communication, the pretreatment chamber including access means for the gaseous test substrate.
3. Apparatus according to claim 1 or claim 2, in which the sensor means comprise an electrochemical sensor comprising two electrochemically-active electrodes separated by an electrolyte absorbed on a porous substrate.
4. Apparatus according to claim 3, in which the sensor electrodes comprise a precious metal as catalyst.
5. Apparatus according to claim 4, in which the catalyst is disposed on a porous support.
6. Apparatus according to claim 4, in which the catalyst is applied direct to the electrode surface in finely-divided form.
7. Apparatus according to any of claims 3 to 6, in which the porous substrate comprises a plastics polymeric material.
8. Apparatus according to any of claims 3 to 7, in which the electrolyte is acidic.
9. Apparatus according to any preceding claim, in which the absorption pre-treatment means comprises an aqueous medium.
10. Apparatus according to claim 9, in which the aqueous medium contains sulphuric acid or other water-retention substance.
11. Apparatus according to claim 9 or claim 10, in which the aqueous medium is absorbed on a solid absorbent matrix.
12. Apparatus according to any preceding claim and including a porous barrier to exclude airborne particulates from the pre-treatment means.

13. A method for sensing the presence of carbon monoxide in a gaseous test substrate which may also contain contaminating substances, the method comprising pre-treating the substrate to absorb any contaminating substances and to convert said contaminating substances to non-contaminating substances and testing the residue of the test substrate for the presence of carbon monoxide.



*Fig.1.*



*Fig.2.*